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NON-LINEAR OPTICAL SIGNAL PROCESSING

Mark Cronin-Golomb
Jed Khoury

Tufts University
Electro-Optics Technology Center
Medford MA 02155

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AIR FORCE RESEARCH LABORATORY
Sensors Directorate
80 Scott Dr
Hanscom AFB MA 01731-2909

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CHARLES WOODS
AFRL/SNHC
Optoelectronic Technology Branch
Electromagnetics Technology Division

APPROVED:

ROBERT V. McGAHAN
Technical Advisor
Electromagnetics Technology Division

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6. AUTHOR(S)
Jehad Khoury, Mark Cronin-Golomb

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Tufts University
Electro-Optics Technology Center
Medford, MA 02155

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Charles Woods
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80 Scott Drive
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In this work we presented a two port nonlinear joint transform correlator with two complimentary results. This correlator is based on a two port photorefractive limiting quadratic processor. In the limiting regime we demonstrated experimentally and by computer simulation, that the correlation operation is like a phase extraction correlator operation, regardless of the sign of the coupling coefficient. However, for positive coupling coefficients and intermediate beam ratios, one port performs as a phase-only filter and the other as a classical matched filter.

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Nonlinear joint transform correlator

In this work we presented two port nonlinear joint transform corrlator with two complementary results. This correlator is based on using a two port photorefractive limiting quadratic processor. In the limiting regime we demonstrated experimentally and by computer simulation, that the correlation operation is like a phase extraction correlator operation, regardless of the sign of the coupling coefficient . However, for positive coupling coefficients and intermediate beam ratios, one port performs as a phase-only filter and the other as a classical matched filter.

Related references

i) "Analysis of dual discrimination ability of two-port photorefractive joint-transform correlator," To appear in Applied Optics.

Optimal correlation design for associative memory

Most of the implementations of associative memories are based on using the Hopfield algorithm. The basis of all holographic implementations uses holograms which multiplex several holographic matched filters. It is well-known that the classical matched filter has a poor discrimination ability and therefore most of the implementation based on the Hopfield algorithm has poor performance. To improve the performance, we first derived the optimal algorithm which maximizes the criteria peak-to noise-ratio (or the discrimination ability). Our algorithm is basically a modification of the Yaroslavsky algorithm.

The hardware implementation of this algorithm is not easy. Therefore, we suggest several

alterations which approximate the optimal algorithm. One alteration is based on using nonlinear saturation amplifiers in architectures with holograms which multiplex several matched filters. The use of a saturation amplifier has proven its effectiveness by ōthers in recalling all of the information when the memory is addressed with 1/50 of the full information. These experimental results verify our derivation of the new algorithm and it's modification.

Related references

"Nearly optimal correlation design for shift associative memories," Appl. Opt. 34, 3971-3980 (1995)

Homodyne and Heterodyne Frequency Classifier

In this work, we demonstrated the operation of an externally- pumped phase conjugate mirror as a frequency division demultiplexer. In this architecture, a self-pumped phase conjugator is pumped by two beams. One is a reference beam, which is phase conjugated via a self-pumped mechanism, and the other is a signal beam, which is conjugated via pumping by the conjugate of the reference beam. For the demultiplexing operation, the signal beam multiplexes many spatial-temporal signals, while the reference beam is temporally modulated. Demultiplexing occurs only if the frequency of the modulation in the reference beam is equal to the frequency of one of the signals.

Related References

"Demultiplexing and phase-locking via self pumped phase conjugate mirror" The Proc. of the SPIE, B. Javidi and J. L. Horner edited, 2565, 155-256 (1995)